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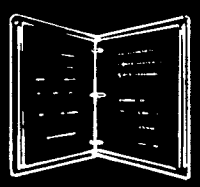
VOLUME 10 NUMBER 5

Field Notes



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U.S. DEPARTMENT OF AGRICULTURE

ENGINEERING FIELD NOTES

Volume 10 Number 5

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DIAMOND CORE DRILLING WITH AIR - 1977

AN EVALUATION

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Engineer/Geologist
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Region 1

During the spring of 1977, Bob Hinshaw and Jim Northrup of Region 1 discussed the possibility and advantages of core drilling using air instead of water as a drill medium for subsurface investigations. The Wyoming and Montana highway departments had been using air in some coring operations and Northrup had used it in California. His experience--100 percent core recovery with air in ground in which 60 to 70 percent recovery was normal--was encouraging. Northrup and Hinshaw agreed that the use of air should be evaluated during the 1977 drill season.

The project chosen for evaluation was the proposed Kelly Creek quarry on the St. Maries Zone, Idaho Panhandle National Forest; the rock is highly fractured diabase. The quarry site had been partially drilled using water during the 1976 field season and the results had been discouraging with generally less than 50 percent recovery. With this kind of recovery, it was not possible to evaluate the quality of the site, since it was not known if the lost material had been usuable or not.

In July 1977, the Regional Office rented an Ingersoll-Rand 600-cfm, 120 psi compressor. Four holes were drilled in the Kelly Creek site with a truck mounted Mobile B-50 drill using air with a bentonite-detergent foam. The core barrels and bits were standard types designed for use with water. Three holes were drilled at the same locations, which had produced poor core recovery in 1976. The first hole was cored with a BHR wireline core barrel (the same size used in 1976). Two core barrels were stuck in the first hole; the remaining coring was done with NC size (the next larger size) with no problems. The following is a summary of the results.

(1) Core Recovery. The increased core recovery was impressive (see figures). The recovery in Hole 1A drilled with air was 72 percent as compared to 51 percent with water; in Hole 2 the recovery was 73 percent with air as compared with 26 percent with water; in Hole 3 the recovery was 92 percent with air as compared with 51 percent with water. This increase was not merely the result of the larger core (NC), as is shown by the BHR recovery in Hole 1A. Coring with air and bentonite

foam definitely resulted in a significant increase in core recovery and thus enabled evaluation of the materials source.

(2) Core Bit Wear. Part of the initial concern was the potential of increasing the wear of the diamond bit when drilling with air. In 1976, the average endurance distance of five bits used with water was 31.6 feet (9.63 meters). In 1977, the average distance of one bit used with air was 48.5 feet (14.78 meters). Two other bits used with air were not worn out after 20 feet (6.10 meters).

While the data is not sufficient to draw a final conclusion, bit wear when air is used appears to be less than that when water is used. One factor that would contribute to higher bit wear with water use is the grounding up and washing away of much of the material not recovered from the hole. Thus, the water bit would have to cut more material than one like the air bit that was getting better recovery. Also, from the size and amount of the cuttings obtained with air, it appears that air was much more efficient in removing cuttings from the hole.

Diamond core drilling with air may be beneficial in certain situations: (1) where water is not available; and (2) where difficult drilling conditions exist and core recovery with water is poor. The results of this project are promising enough to warrant further use and evaluation. Improvements may be possible in the future with the use of core barrels and bits especially designed for use with air.

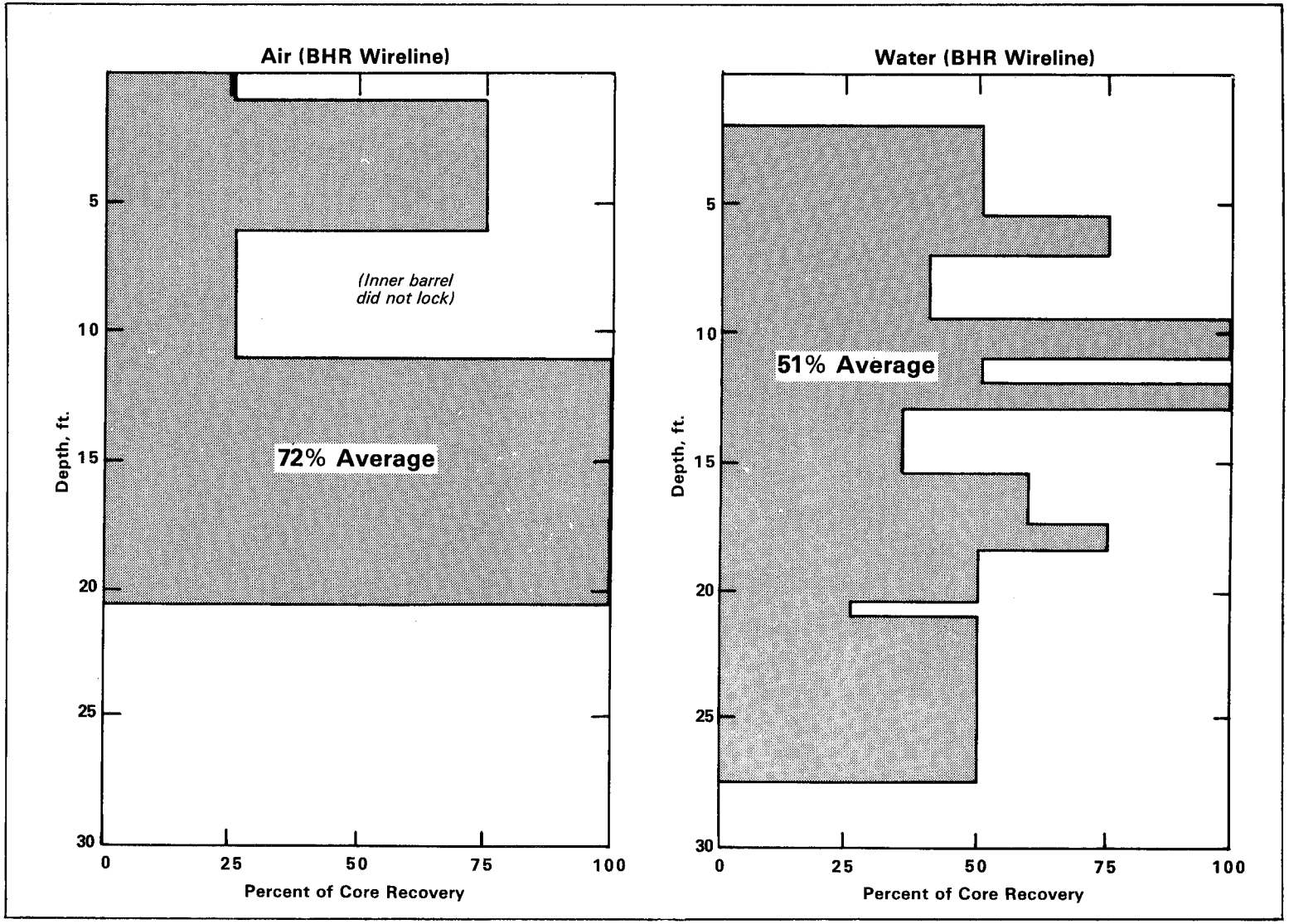

Figure 1. Hole No. 1A--Core recovery comparison air vs. water.

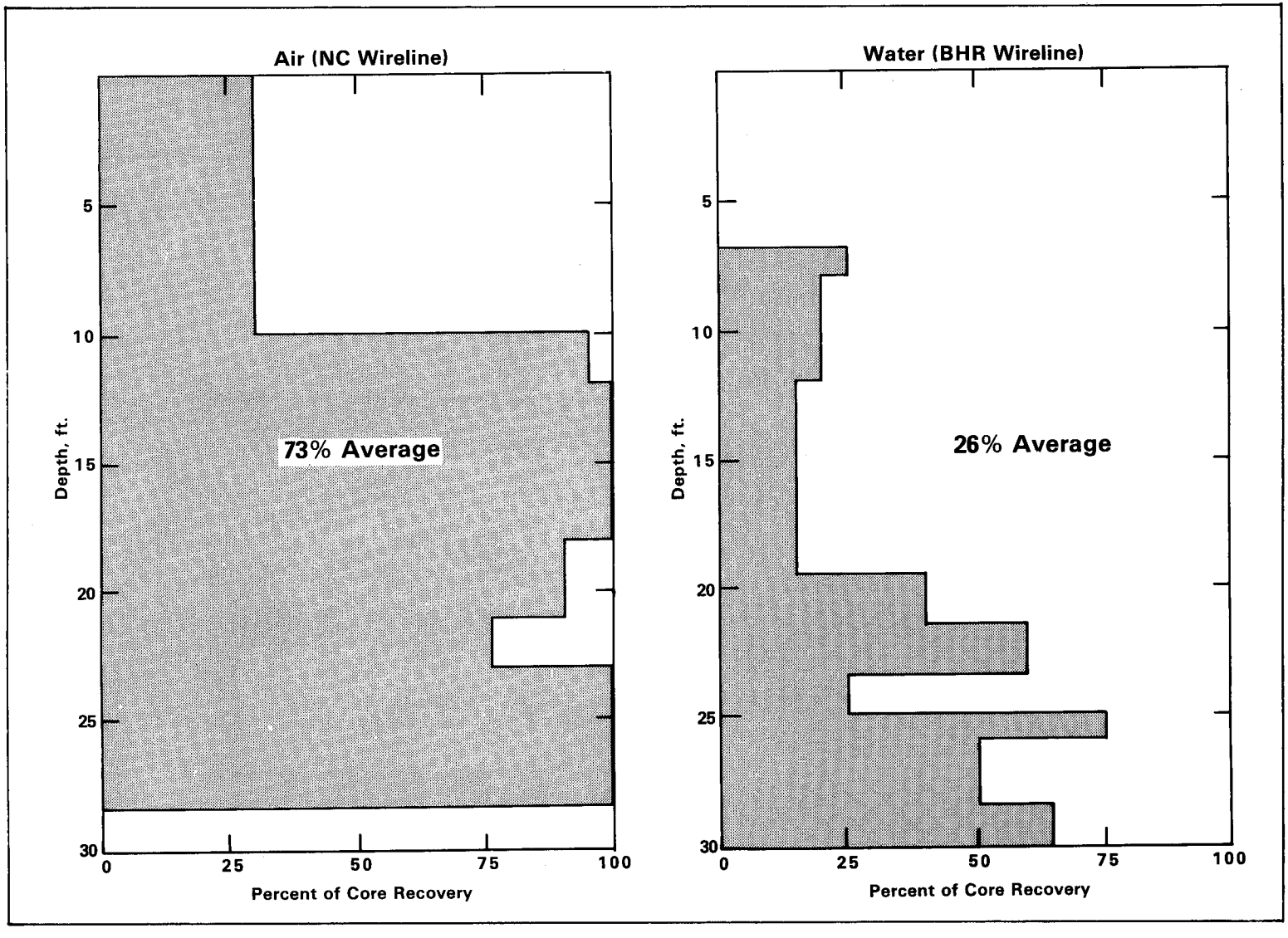

Figure 2. Hole No. 2--Core recovery comparison air vs. water.

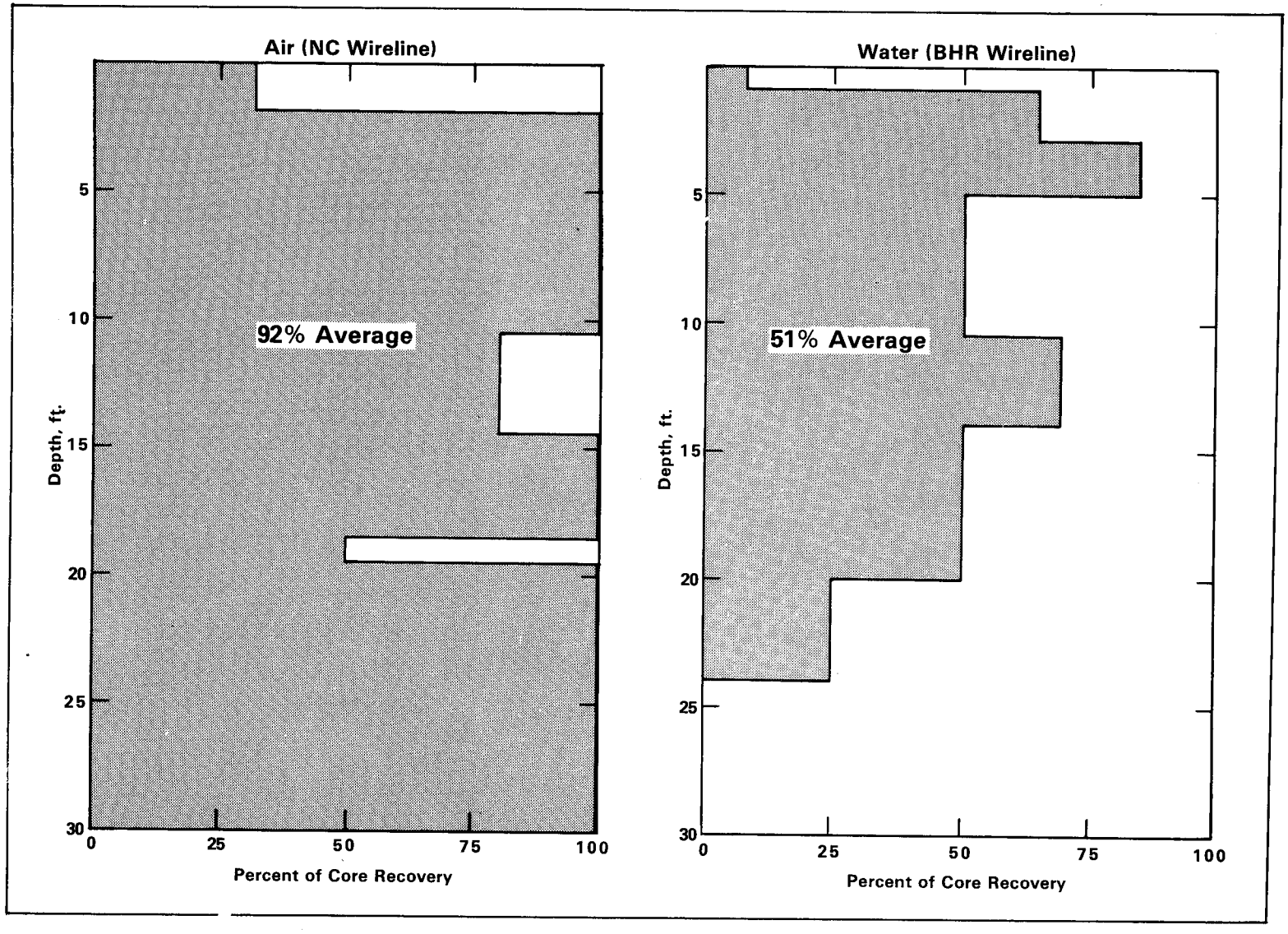

Figure 3. Hole No. 3--Core recovery comparison air vs. water.

ISLAND LAKE CREEK TIMBER CULVERT

Robert H. McDonald
Inspector

Glen R. Anderson
Engineer

Chippewa National Forest
Region 9

Project

The Island Lake Creek Bridge, constructed of native logs in the 1940's, had both an inadequate load capacity and width. There was no practical method to increase the width of the log abutments or to determine their condition; therefore, the decision was made to replace the structure.

A cost analysis to compare materials and installation costs of concrete, structural plate, and timber culverts revealed the following:

Materials	Installation Costs
Concrete Box Culvert	$8,400
Structural Plate Pipe Arch	8,236
Twin Timber Box Culvert	6,668[1]

[1]The actual bid price for the timber culvert was $8,000, including the contractor's overhead and profit.

A contract to remove the bridge, install the timber culvert, change the channel, and raise the road grade was awarded to N. E. Fallgren of Laporte, Minnesota, on September 15, 1976.

Construction

The first phase of construction was to install the timber culvert about 100 feet (30.48 meters) north of the bridge. Next, the channel change was executed with a dragline to route the stream through the culvert. The old bridge was removed and borrow was hauled to the site so the road could be graded. Marsh material, which was removed in excavating the new channel, was deposited in the old channel and placed on the road slopes as topsoil.

Culvert excavation was 18 inches (45.72 centimeters) below the bottom of the culvert. The bottom of the excavation was sand. Eighteen inches (45.72 centimeters) of gravel fill was placed and compacted to form the

bed for the culvert. The bottom sections of the culvert were placed on the gravel bed. The sides and center wall were installed and held in place with temporary bracing, and the top of the structure was lowered into the walls (fig. 1). The floor, wall, and top sections were made of laminated pieces that dovetailed.

Because the contractor was careful to assure that all parts were installed level and vertical, no major problems were encountered in the culvert assembly. It is very important on a structure of this type to have a perfectly solid and level bed. The walls must be held in a true vertical position. The backfill must be brought up equally on the sides to assure that the pressures are equal and there are no distortions.

Conclusion

The Island Lake Creek timber culvert project was very successful, and the structure blended nicely with the landscape (fig. 2). In addition to being the most economical alternative, the treated timber culvert also met land management objectives. Other timber culvert installations on the Chippewa, including use as spillways on small wildlife impoundments, have been equally successful.

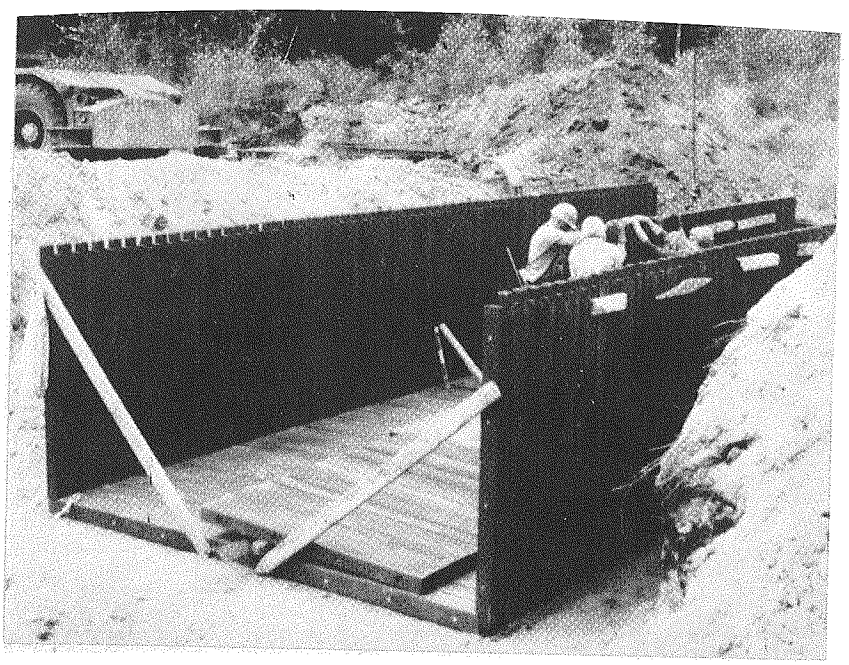

Figure 1. Tongue and groove joints and scrap lumber are used to hold section in place.

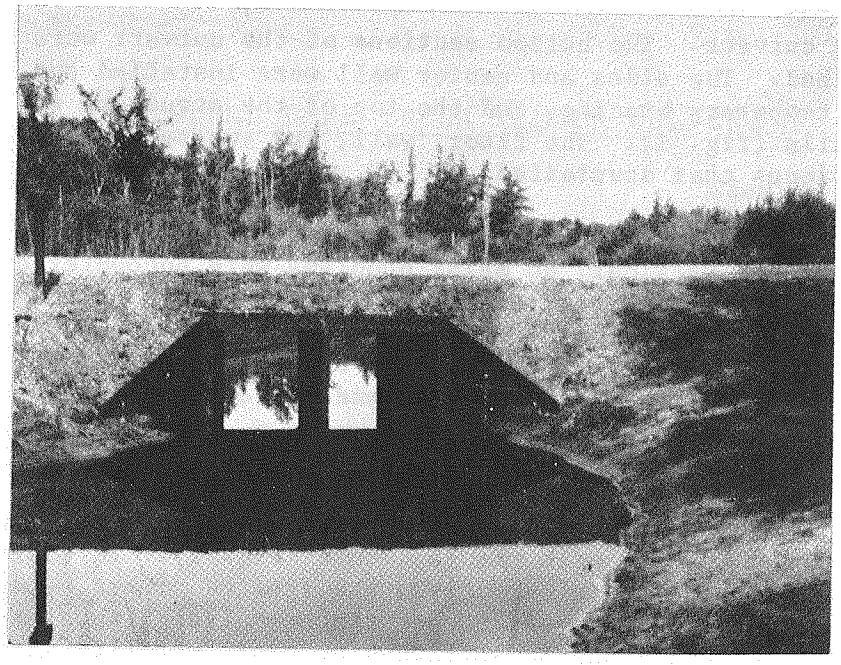

Figure 2. The completed Island Lake Creek Timber Culvert complements its surroundings.

CRIMINAL LIABILITY OF THE FIELD ENGINEER

Reprinted from Engineering Issues October 1977, pages 287-289, with permission of the American Society of Civil Engineers.

The following article documents the trials and tribulations of a State Department of Transportation engineer. He was a Resident Engineer on a construction job on which a serious accident occurred. Because he was the state's representative, he became embroiled in a prolonged, costly, and frustrating legal battle. In this age of increased legal activism, Forest Service engineers should be informed and aware of, and alert to, their potential personal involvement in construtionrelated accidents. The old saying, "Safety is everybody's business," takes on added dimensions when personal liability may be involved.

--Heyward T. Taylor
Assistant Director
Technological Improvements

CRIMINAL LIABILITY OF THE FIELD ENGINEER[a]

By Frederick Richards,[1] M. ASCE

Lunch time was always a good time in Worcester, Mass. for Francis Germain, Jr.; as an apprentice oiler he would shut the crane down and take off for lunch with the ironworkers, his father, and their fascinating tales of the "high steel."

On April 16, 1968 at 11:45 a.m., Mr. Germain, Sr. lifted the first bridge girder for Span No. 8, dropped it on the fixed end, rested it upon the expansion end, applied a 2-ton (1,814-kg) strain to the 15-ton (13,608-kg) girder, locked the crane, and climbed down for lunch.

At 12:35 p.m., Resident Engineer, John R. Horan heard a terrific roar coming from the Bridge at Southbridge Street. He left his field office and observed that the beams had collapsed under the lunchtime vehicular traffic. Fire! A 2,000-gal (7.6-m^3) gasoline tank truck was burning and some vehicles and drivers were trapped in the holocaust. Horan saw two of the contractor's men attempting to rescue the trapped victims when suddenly there was a second large roar, additional beams fell, entombing the already entrapped victims along with their intended rescuers.

The final toll of the disaster which took less than 5 min to develop: three dead, eight seriously injured. And then it was over! But not for the Resident Engineer for the Department of Public Works—John R. Horan; who like more than 15,000 other resident engineers connected with the construction industry, had simply shown up for work that day on his highway project, the Worcester Expressway. The Construction Handbook of the American Association of State Highway Officials states that resident engineers such as Mr. Horan have no control over the *methods* of operation but merely monitor the work to assure conformance with the plans and specifications. Horan knew this and knew that this was the policy as proscribed by the Commonwealth of Massachusetts. The failure was characterized by the lateral buckling of the unsupported compression flange accompanied by torsion of the section, and could have been avoided by the employment of erection procedures compatible with the design. Horan realized that erection procedures were listed in the general category of methods of operation, an area for which he was not responsible, and thus he would

Note.—Discussion open until March 1, 1978. To extend the closing date one month, a written request must be filed with the Editor of Professional Publications, ASCE. This paper is part of the copyrighted Engineering Issues—Journal of Professional Activities, Proceedings of the American Society of Civil Engineers, Vol. 103, No. E14, October, 1977.

[a]Presented at the September 27-October 1, 1976, ASCE Annual Convention and Exposition, held at Philadelphia, Pa. (Preprint 2761).

[1]Assoc. Civ. Engr., N.Y. State Dept. of Transportation, Rochester, N.Y.

not be involved in the criminal or civil proceedings.

Involved? The system sought to rest the *entire* responsibility of the Commonwealth of Massachusetts upon his fragile shoulders.

Involved? He was ensnared, entrapped, implicated, and finally submerged *alone* in the sea of liability. He was prosecuted by a vigorous Attorney General. He was interrogated at the inquest. He was indicted by the Grand Jury on three counts of manslaughter. He was arraigned in Superior Court by Judge John M. Noonan. He became personally responsible for $27,750 in legal expenses. And according to Horan, he suffered many personal and other hardships, due to the proceedings, for a period in excess of five years.

And then it was over! John R. Horan was found *not guilty of anything,* by a directed verdict of the Worcester Superior Court. How could this have happened to a resident engineer who simply showed up for work on the day of a disaster?

They did it!

And they did it after the collapse of a tower under construction at Skyline Center, Bailey's Crossroads, Va., killing 14 workers and injuring 34 others (*Civil Engineering*, ASCE, Nov., 1975).

And they did it after the collapse of the New York State Barge Canal at Bushnell's Basin (*Democrat and Chronicle*, October 30, 1974).

And they are doing it in Alabama.

And they will do it whenever an engineering disaster occurs and a resident engineer can be found.

Who are they? According to the former New York State assistant District Attorney, Vincent P. Mitrano (Monroe County), *they* are the ones who will not explicitly define the responsibilities of the resident engineer in the contract documents. These are the "fat cats," commissioners, chief engineers, district engineers, some politicians, and others in the $25,000 to $45,000 salary range who are themselves protected from liability under the Discretionary Rule, (Transportation Research Board, R.R.D., *Digest 79*); and who are absolutely immune from all the hardships that are associated with this liability.

The next person in the queue, after the "fat cats" is the resident engineer, who becomes responsible for the disaster and is indicted, and thus shoulders the full responsibility of the "inverted triangle," for the engineering hierarchy.

THE SOLUTION

According to Domenico J. Alfano, The Hearing Examiner, Commonwealth of Massachusetts, Department of Public Works, each contract should contain a statement that defines the responsibilities of the resident engineer and mentions the resident engineer specifically by *title*.

According to Alfano, officials also have a moral responsibility to protect the resident engineer from financial loss and should insist that legislation be enacted so that at least the resident engineer will not have to carry the full financial burden along with the other hardships. The following form is suggested.

INDEMNIFICATION OF OFFICERS AND EMPLOYEES OF THE STATE

The state shall save harmless and indemnify all officers and employees of the state from financial loss arising out of any claim, demand, suit, or judgment

by reason of alleged negligence or other act by such officer or employee provided that such officer or employee at the time damages were sustained was acting in the discharge of his duties and within the scope of his employment and that such damages did not result from the willful and wrongful act or gross negligence of such officer or employee (McKinney's Consolidated Laws of New York, Annotated, Public Officers Law, 17).

CONCLUSION

Certainly the time to enact legislation beneficial to the resident engineer is *before* the disaster. The time to act, is now!

WASHINGTON OFFICE NEWS

CONSULTATION AND STANDARDS

Walter E. Furen
Assistant Director

PLANNED REVISION OF 1977 ROAD AND BRIDGE CONSTRUCTION SPECIFICATIONS

The 1977 *Forest Service General Provisions and Standards Specifications for Construction of Roads and Bridges* were quickly developed to facilitate implementation of Section 14(i) of the *National Forest Management Act* (small business road option).

It was intended from the outset that the specifications would be thoroughly reviewed and updated as soon as practical. The updated version is expected to be available for field use by August 1, 1979.

A standing committee has been appointed to ensure that the necessary information is gathered, evaluated, and incorporated into the revision. By September 1, 1978, committee members will have secured documented suggestions from such sources as:

External Sources:

1. Timber industry representatives
2. A.G.C. organizations
3. Testing laboratories performing tests required by specifications
4. Federal Agencies
5. American Road and Transportation Builders' Association
6. Contractors
7. Material suppliers and manufacturers
8. Other special interest groups (including National Forest users such as sportsmen, conservationists, environmentalists, and recreationists) concerned with road specifications.

Internal Sources:

1. Contracting Officers from Administrative Services
2. Timber Sales Admninistration Officers
3. Fiscal and Accounting Management (persons involved with claims)
4. Resource Specialists

a. Fire Management (slash disposal, roadside vegetation, developing water supplies, etc.)
b. Range Management (fencing, cattleguards, seeding specifications, etc.)
c. Recreation (roadside treatments, signing, etc.)
d. Watershed and water planning groups (erosion control, excavation, developing water supplies, structures, etc.)
e. Fish and Wildlife (structures, drainage, clearing, grubbing, developing water supplies, roadside revegetation, etc.)

5. Engineers - preconstruction, construction, material, etc.
6. Certified ER's, COR's, and Inspectors
7. Office of General Council
8. Other staff as appropriate

Committee members seeking information are as follows:

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Ben Carson	Forest Service USDA P.O. Box 2417 Washington, DC 20013	8-247-4051
Bud Unruh	Forest Service USDA, Engineering Staff P.O. Box 2417 Washington, DC 20013	8-235-9843

Inputs from persons who have been working with the 1977 specifications in preparing and administering contracts will be especially valuable for the identification of errors and problem areas. All interested parties are invited to submit suggestions to committee members. A format similar to the following is desirable.

To _____

Comments and Recommendations
on 1977
Forest Service General Provisions and Standard Specifications
for Construction of Roads and Bridges

Submitted by _____ Date _____

Page No. _____ Section No. _____

Title _____

Paragraph No. _____ Line No. _____ Sentence No. _____

Present Text Reads

Recommended Text

Reasons

OPERATIONS

Harold L. Strickland
Assistant Director

IMPROVING OUR CONGRESSIONAL CORRESPONDENCE

Letters are the main formal communication tool used in conducting our business. Each author, reviewer, and signer has a personal responsibility to the reader for the quality and content of each letter. Everyone you write to deserves the best, regardless of who they are, or what position they hold.

An increasing amount of Congressional correspondence reaching the Washington Office, either as information copies or as final drafts, shows a lack of attention to writing, editing, and review.

Here are some examples:

Example 1 -- Letter to a Senator-February 6, 1978

> A design was prepared and a project agreement..negotiated.. on September 30, 1978 for repair of the bridge. High water prevented work on the bridge last fall, and repairs were to be delayed until late this spring when the water lowers.

Obviously, there is a date error in this paragraph, unless the writer meant the project agreement "will be negotiated...on September 30, 1978."

> The recent January thaw and heavy rains again inundated the bridge beneath over five feet of water, causing further shifting of piers and, finally, a break in the superstructure.

The paragraph could be revised to read: The January thaw and heavy rains caused further shifting of the piers and a break in the deck, making the bridge impassable.

> It is anticipated that the new structure will be approximately 130 feet, plus or minus, long...We anticipate proposing replacement...in Fiscal Year 1980...since repair of the present structure will not solve the problems with the low water structure.

The last paragraph of the example is difficult to follow and not very meaningful. A suggested revision is:

> To correct the situation, a new structure, approximately 130 feet long, will be proposed for funding in Fiscal Year 1980, since repairing the present structure will not prevent flooding damage.

Example 2 -- Letter to a Congressman-February 6, 1978

> However we have no authority to snowplow roads for private residences living on private land along the road.

First of all, "residences" (homes) do not "live" along the road. A suggested revision for this sentence is:

> However, we have no authority to snowplow roads for private citizens whose homes are located along the road.

Example 3 -- Letter to a Congressman-November 9, 1977

> There are approximately 500 miles of National Forest, State, and privately owned roads which are narrow, one lane, usually unsurfaced, and capable of only low travel speeds.

Roads are immovable facilities, and are incapable of speed! The sentence could be revised to read:

> There are approximately 500 miles of National Forest, State, and privately-owned roads which are narrow, one lane, usually unsurfaced, and designed only for low-speed traffic.

We did not make up these examples. They were taken from Congressional correspondence; one was signed by a Regional Line Officer, and two were signed by Forest Line Officers. We are also aware that some of these same problems exist in correspondence which originates in the Washington Office.

We all must work harder to ensure that our correspondence is readable and understandable. Review what you write! Ask yourself if you would use the same words if you were talking face-to-face. Remember that the reader is looking for information or answers, not more confusion.

Frequently, Congressmen and Senators will request a brief statement; if so, do not respond with a "book." Make the statement brief; respond with the information that is being requested. Be factual, and be positive. If you do not know the answer, and you are unalbe to find it, say so. We are specialists in our various fields; be sure that our correspondence indicates this.

INVITATION TO READERS OF *FIELD NOTES*

Every reader is a potential author of an article for *Field Notes.* If you have a news item or short article you would like to share with Service engineers, we invite you to send it for publication in *Field Notes.*

Material submitted to the Washington Office for publication should be reviewed by the respective Regional Office to see that the information is current, timely, technically accurate, informative, and of interest to engineers Service-wide (FSM 7113). The length of material submitted may vary from several short sentences to several typewritten pages; however, short articles or news items are preferred. All material submitted to the Washington Office should be typed double-spaced; all illustrations should be original drawings or glossy black and white photos.

Field Notes is distributed from the Washington Office directly to all Regional, Station, and Area Headquarters, Forests, and Forest Service retirees. If you are not currently on the mailing list ask your Office Manager or the Regional Information Coordinator to increase the number of copies sent to your office. Copies of back issues are also available from the Washington Office.

Each Region has an Information Coordinator to whom field personnel should submit both questions and material for publication. The Coordinators are:

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R-2	Royal M. Ryser	R-5	Jim McCoy	R-10	F. W. Baxandall
R-3	Juan Gomez	R-6	Kjell Bakke	WO	Al Colley
		R-8	Bob Bowers		

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